

## Additional QIE8 measurements (6/24/03)

### 1<sup>st</sup> Chip (from engineering wafer, used for original test)

I added some measurement points with smaller current, using the same chip as before. Below 0.5 uA, the time response did not appear to change significantly for even the lowest bias, so the 0.25 uA measurement was not repeated for the higher bias cases.

Rbias = 750K (external Ibias = 4.1 uA, internal bias current = 1.03 uA):

Peak Current (uA)	DATA(0)	DATA(1)	DATA(2)	DATA(3)	DATA(4)	DELAY (ns)
0.5	1(0)	8 ½ (0)	5 ½ (0)	1 ¼ (0)	½ (0)	-16
0.25	½ (0)	4 ½ (0)	2 ½ (0)	½ (0)	¼ (0)	-16

Rbias = 304K (external Ibias = 8.3 uA, internal bias current = 2.1 uA):

Peak Current (uA)	DATA(0)	DATA(1)	DATA(2)	DATA(3)	DATA(4)	DELAY (ns)
0.5	2 ¼ (0)	9 ½ (0)	3 ½ (0)	½ (0)	0(0)	-10

Rbias = 158K (external Ibias = 13.1 uA, internal bias current = 3.3 uA):

Peak Current (uA)	DATA(0)	DATA(1)	DATA(2)	DATA(3)	DATA(4)	DELAY (ns)
0.5	3 ¾ (0)	9 ¾ (0)	2 ½ (0)	½ (0)	0(0)	-6.5

Note that the 0.5 uA measurement is given to ¼ bit resolution. More care was given to this measurement since the signal amplitude is so low. Averaging was used to obtain better accuracy.

Next I measured 2 (yes, two!) more chips, one from the a production wafer, and one from an engineering wafer.

### **Chip #2 (from production wafer)**

Note that the peak current values are somewhat different than on the original. I remeasured the pulse amplitude and I think these are more accurate.

Rbias = 750K (external Ibias = 4.1 uA, internal bias current = 1.03 uA):

Peak Current (uA)	DATA(0)	DATA(1)	DATA(2)	DATA(3)	DATA(4)	DELAY (ns)
525	28(3)	26(3)	23(2)	22(1)	28(0)	0
30	3(2)	2(2)	8(1)	22(0)	11(0)	0
10	12(1)	16(1)	26(0)	14(0)	5(0)	-2.5
3	18(0)	29(0)	15(0)	5(0)	2(0)	-7
1	5(0)	17(0)	7(0)	2(0)	1(0)	-11
0.5	1 ½ (0)	9 ¼ (0)	4 ½ (0)	1 (0)	¼ (0)	-14

Rbias = 304K (external Ibias = 8.3 uA, internal bias current = 2.1 uA):

Peak Current (uA)	DATA(0)	DATA(1)	DATA(2)	DATA(3)	DATA(4)	DELAY (ns)
525	27(3)	26(3)	24(2)	22(1)	27(0)	0
30	3(2)	2(2)	8(1)	21(0)	8(0)	0
10	13(1)	16(1)	24(0)	9(0)	2(0)	-1.5
3	22(0)	28(0)	13(0)	3(0)	1(0)	-4.5
1	9(0)	17(0)	5(0)	1(0)	1(0)	-6.5
0.5	3(0)	10(0)	2 ¾ (0)	¼ (0)	0(0)	-7

Rbias = 158K (external Ibias = 13.1 uA, internal bias current = 3.3 uA):

Peak Current (uA)	DATA(0)	DATA(1)	DATA(2)	DATA(3)	DATA(4)	DELAY (ns)
525	27(3)	26(3)	24(2)	22(1)	26(0)	0
30	3(2)	2(2)	8(1)	20(0)	7(0)	0
10	14(1)	16(1)	24(0)	8(0)	3(0)	-1.5
3	23(0)	28(0)	11(0)	3(0)	2(0)	-3.5
1	11(0)	17(0)	4(0)	1(0)	1(0)	-3.5
0.5	4 ¾ (0)	9 ¾ (0)	2 ¼ (0)	¼ (0)	0(0)	-3.5

### Chip #3 (from engineering wafer)

Note that the peak current values are somewhat different than on the original. I remeasured the pulse amplitude and I think these are more accurate.

Rbias = 750K (external Ibias = 4.1 uA, internal bias current = 1.03 uA):

Peak Current (uA)	DATA(0)	DATA(1)	DATA(2)	DATA(3)	DATA(4)	DELAY (ns)
30	2(2)	3(2)	9(1)	22(0)	11(0)	-0.5
10	10(1)	17(1)	26(0)	13(0)	5(0)	-3
3	16(0)	29(0)	15(0)	5(0)	2(0)	-7.5
1	4(0)	17(0)	7(0)	2(0)	1(0)	-13
0.5	1 ½ (0)	9 ½ (0)	4 ¼ (0)	1 (0)	¼ (0)	-14

Rbias = 304K (external Ibias = 8.3 uA, internal bias current = 2.1 uA):

Peak Current (uA)	DATA(0)	DATA(1)	DATA(2)	DATA(3)	DATA(4)	DELAY (ns)
30	3(2)	3(2)	8(1)	21(0)	8(0)	0
10	11(1)	16(1)	23(0)	9(0)	3(0)	-2
3	21(0)	29(0)	13(0)	3(0)	2(0)	-5
1	8(0)	17(0)	5(0)	1(0)	0(0)	-6.5
0.5	3 ½ (0)	10(0)	2 ¾ (0)	¼ (0)	0(0)	-8

Rbias = 158K (external Ibias = 13.1 uA, internal bias current = 3.3 uA):

Peak Current (uA)	DATA(0)	DATA(1)	DATA(2)	DATA(3)	DATA(4)	DELAY (ns)
30	3(2)	3(2)	8(1)	20(0)	6(0)	0
10	14(1)	17(1)	23(0)	9(0)	2(0)	-1.5
3	23(0)	28(0)	11(0)	2(0)	2(0)	-3.5
1	11(0)	16(0)	4(0)	1(0)	0(0)	-4
0.5	4 ½ (0)	9 ½ (0)	2 (0)	¼ (0)	0(0)	-5

I also did a check on the non-inverting input. For the nominal bias current, a “PMT-like” input pulse that is 10 ns wide base to base is completely integrated in one bucket for ALL amplitudes. This is done under the condition where the pulse is timed to arrive at the beginning of the bucket ( 1 or 2 ns after the integration starts). I can delay the input pulse for at least 5 ns before charge begins spilling over into the next bucket.

Be aware that this represents the QIE response only. By adding long cables on the input, and depending on the dispersion properties of the cable, the pulse can be smeared out so that it does not all arrive in one bucket.